EMULEX®

Deployment Guide: Network Convergence with Emulex® OneConnect™ OCe10102-F FCoE CNA and Windows Server Platform

How to deploy converged networking with a Windows Server platform using Emulex FCoE technology

At a Glance

Windows users look to Emulex for high performance, scalable, reliable connectivity solutions. With converged networking, Windows users now have greater choices when deploying a Storage Area Network (SAN) with iSCSI and Fibre Channel over Ethernet (FCoE) protocols. The Emulex OneConnect Universal Converged Network Adapters (CNAs) leverage ten generations of advanced, field-proven LightPulse™ Fibre Channel Host Bus Adapter (HBA) technology, making them ideal for server I/O consolidation.

This deployment guide reviews Data Center Bridging (DCB) as the foundation of network convergence; includes a technology overview of FCoE; and provides a detailed description of how to configure an Emulex OneConnect FCoE CNA and deploy converged networking with FCoE in a Windows Server environment.

Products

- Emulex® OneConnect™ OCe10102-F FCoE CNA
- Emulex OneCommand™ Manager application
- Emulex AutoPilot Installer®
- Windows Server 2003, 2008 and 2008 R2

Introduction

Fibre Channel over Ethernet (FCoE) is a standard developed by INCITS T11 that fully leverages the enhanced features of 10 Gigabit Ethernet (10GbE) for I/O consolidation in the data center. The Emulex OneConnect Universal Converged Network Adapter (CNA) is the first adapter to provide protocol offloads for TCP/IP, FCoE and iSCSI with a single product platform. It allows companies to wire once, creating a seamless upgrade path to solidify the benefits of network convergence.

Emulex has a long and successful history of working closely with Microsoft and other partners to leverage new technologies that evolve in converged network environments. This deployment guide presents information about network convergence and also provides an overview of how to realize the maximum benefits when deploying OneConnect FCoE technology with Windows Server 2003, 2008 and 2008 R2.

Network Convergence

The combination of high bandwidth demand, increasing network sprawl and the growing need for more adaptive networking infrastructure is posing a major challenge for data center managers. Pain points in today's data center networks include:

- Multiple network fabrics, each dedicated to a specific type of traffic
- High numbers of adapters and switch ports
- Complicated cabling infrastructure
- Complex management of switch and adapter firmware and associated service contracts

OneConnect™ OneCommand™

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The Data Center Networking Challenge

Data center managers are clearly in need of networking solutions that contain the sprawl of network infrastructure and enable an adaptive next-generation network. The solution for optimizing the data center network must be capable of addressing the following high level requirements:

- **Consolidate**—Replace multiple 1GbE links with a high-bandwidth 10GbE infrastructure, significantly reducing the number of switch ports, adapter ports and cables.

- **Converge**—Unify networking and storage traffic to a single network, eliminating the need for dedicated networks for each traffic type.

- **Virtualize**—Virtualize the underlying physical network infrastructure and provide service level guarantees for each type of traffic. In addition, the solution must be capable of responding to dynamic changes in network services based on the business demands of data center applications.
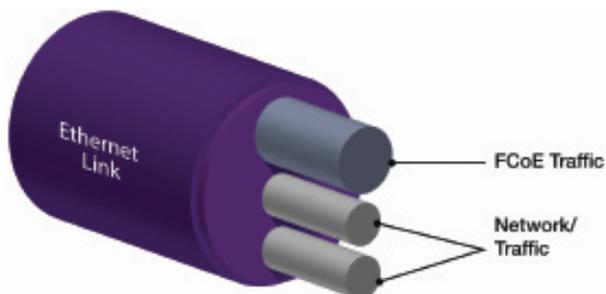

Figure 1 DCB enables multiple traffic type over a single link

Data Center Bridging:
The Foundation for Network Convergence

The IEEE Data Center Bridging (DCB) standard enables multiple traffic types over a single link, or network convergence, as shown in Figure 1 for FCoE.

The key DCB standards that enable network convergence are:

- **Priority Flow Control (PFC)**—Pause-based I/O management between an initiator and target on a multi-protocol Ethernet link that insures low latency and eliminates re-transmissions for lost packets (referred to as "lossless" Ethernet)

- **Quality of Service (QoS)**—Support for 8 network traffic priorities

- **Enhanced Transmission Selection (ETS)**—Bandwidth allocation for multiple protocols

FCoE Technology Overview

The FCoE protocol specification provides for direct encapsulation of a complete Fibre Channel frame (including checksum and framing bits) within an Ethernet frame and avoids the overhead of any intermediate protocols (see Figure 2).

Figure 2 FCoE encapsulation in Ethernet

This lightweight encapsulation ensures that FCoE-capable Ethernet switches are less compute-intensive, providing high performance that is typical of a Fibre Channel network. By retaining Fibre Channel as the upper layer protocol, FCoE fully supports critical Fibre Channel capabilities, including fabric login, zoning and Logical Unit Number (LUN) masking.

Figure 3 shows how networking and Fibre Channel software stacks use a common Ethernet infrastructure to achieve convergence in the data center.
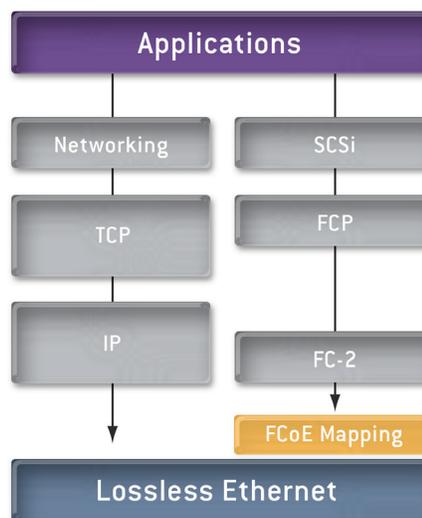

Figure 3 Networking and Fibre Channel stacks

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Benefits of Network Convergence and FCoE

The combination of network convergence and FCoE provide the following key benefits to IT organizations:

- **Infrastructure simplification**—Network and storage I/O is converged over a single 10GbE infrastructure that supports SAN and Local Area Network (LAN) connectivity with common adapters, switch ports and cables.

- **Protection for existing Fibre Channel investments**—FCoE is designed to fully leverage existing Fibre Channel investments. Deployments begin at the edge of the data center and storage traffic is routed by a Fibre Channel forwarding switch into the existing Fibre Channel SAN. Full interoperability with installed Fibre Channel switches and arrays means no need to "rip and replace". Even more critical, there's no requirement to move and potentially disrupt access to data. A common management framework across Fibre Channel and FCoE connected servers protects existing investments in management tools and processes and lowers long-term operating costs.

- **Increased IT efficiency and business agility**—A converged network streamlines and eliminates repeated administrative tasks such as server and network provisioning with a "wire once" deployment model. The converged network also improves business agility letting data centers dynamically and rapidly respond to requests for new or expanded services, new servers and new configurations.

Emulex OneConnect OCe10102-F FCoE CNA

The Emulex OneConnect OCe10102-F is a single-chip 10GbE CNA that supports FCoE while leveraging mature Fibre Channel management tools and processes (see Figure 4). The OCe10102-F offloads Fibre Channel protocol processing from the CPU, providing high performance storage connectivity and optimized CPU utilization. The additional processing power retained by CPUs provides more CPU bandwidth for enterprise applications and enables the deployment of more VMs per virtualized server.

Emulex FCoE CNAs leverage ten generations of advanced, field-proven LightPulse™ Fibre Channel HBA technology, making them ideal for server I/O consolidation.

Figure 4 Emulex OneConnect OCe10102-F FCoE CNA

Converged Network Deployment Models

The combination of DCB-enabled Ethernet switches and Emulex CNAs has facilitated the adoption of FCoE and 10GbE as the converged network fabric.

FCoE switches are typically provisioned at the edge of the network. They detect Ethernet frames with encapsulated Fibre Channel frames and supply the Fibre Channel Forwarding function for communication to the SAN. Fibre Channel frames are routed over a FC uplink port that can be connected to a Fibre Channel switch (E-port or NPIV mode) or storage array (F-port)

Ethernet ports on the switch provide connectivity to the LAN.
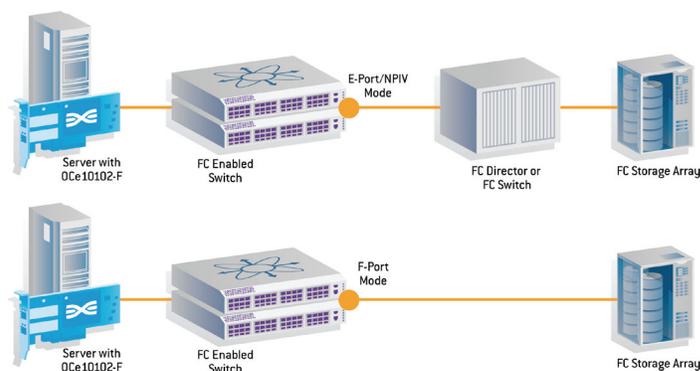
Figure 5 Converged network deployment and access to SAN

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Converged Networking with FCoE in a Windows Environment

The following sections provide details on how to configure an Emulex OneConnect OCe10102-F FCoE CNA and deploy converged networking with FCoE in a Windows Server environment.

CNA Installation
CNAs provide the same functionality as installing separate NICs and Fibre Channel HBAs.
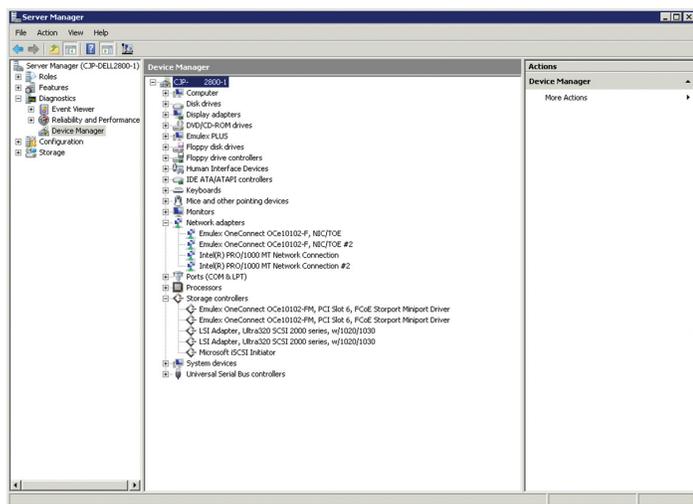
Figure 6 Each CNA port is represented as an HBA and a NIC to Windows Server

CNAs present both NIC and iSCSI or Fibre Channel functionality to the operating system (OS) (see Figure 6). This level of transparency ensures that the CNA configuration and management practices are performed in the same manner as would be done with separate NIC and HBA devices.

Once the Fibre Channel CNA has been installed in the host, Windows Device Manager can be launched from Server Manager to verify that the CNA is recognized by the host. The adapter is visible in Windows Device Manager in the storage adapter view as well as the network adapter view. When deploying multiple CNAs for failover and load balancing, both Fibre Channel multipathing and NIC teaming can be configured.

There are three software components for installation of OneConnect CNAs in a Windows environment:

Storport Miniport driver Download update from www.emulex.com	The Emulex Storport Miniport device driver enables communication with the adapter and a version of the driver is included "in-box" in Windows Server 2003, 2008 and 2008 R2. The inbox Storport Miniport device driver should be updated with the version that is downloaded from the Emulex web site.
OneCommand™ Manager Download from www.emulex.com	The Emulex OneCommand Manager application (previously called HBAnyware®) provides comprehensive management of Emulex adapters on both local and remote servers.
AutoPilot Installer® Included with the OneCommand Manager download	The Emulex AutoPilot utility is used to install the Storport Miniport driver, the OneCommand Manager application and other necessary software.

OneCommand Manager
OneCommand Manager is the successor to the Emulex field-proven HBAnyware management application, and provides centralized management of Emulex fabric (Fibre Channel HBA) and network (iSCSI, FCoE CNA, NIC) adapters in physical and virtual server deployments. It provides powerful provisioning and diagnostic capabilities through a graphical user interface (GUI) as well as a fully scriptable command line user interface (CLI), helping increase administration efficiency and business agility.

AutoPilot Installer
AutoPilot Installer supports a wide variety of installation options from a basic installation on the local server to customizable, automated installations on both local and remote servers. The Storport Miniport User Manual provides details on all of the options. All that is required for a basic installation on the local server is to download and run the distribution kit. The AutoPilot installation automatically installs or updates the driver for all of the adapters on the server and also installs all of the components needed for OneCommand Manager. There is minimal user input and a reboot of Windows is usually not required.

Deployment Guide: Network Convergence with Emulex® OneConnect™ OCe10102-F FCoE CNA and Windows Server Platform

Driver Installation

To begin the driver installation, go to the Emulex website to download the OneCommand Manager utility and driver package (www.emulex.com).

1. From the Emulex web site click on Downloads. This opens the Downloads page. For this example, select Emulex at the top of the vendor list.

2. Under OneConnect UCNAs, click on "UCNA Downloads page".

3. Within the OneConnect UCNA's Downloads and Documentation section there are a number of supported operating systems listed. For this example, we will select "Drivers with the Enterprise Management Application" in the Windows section. This download includes the full OneCommand Manager (GUI and CLI).

The "Windows Downloads for Emulex OCe10102 UCNA" page is displayed, which includes drivers, applications, firmware, boot code and documentation for the Enterprise Application Kit (Figure 7).
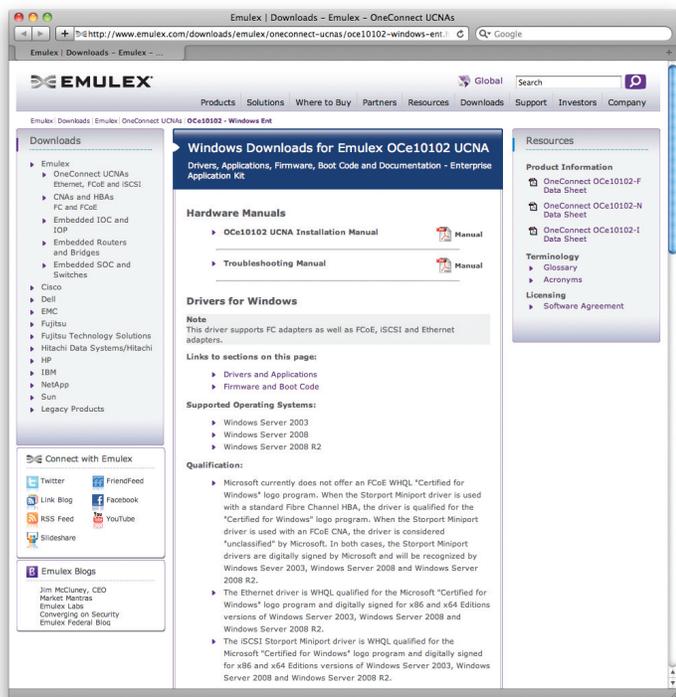

Figure 7 The Windows Download page for Emulex OCe10102 UCNA is available at www.emulex.com/downloads/emulex/oneconnect-ucnas/oce10102-windows-ent.html

Note—The "Supported Protocol" section shows all of the drivers and supported devices for each of the protocols. For FC and FCoE, this includes multiple generations of LightPulse™ Fibre Channel HBAs, OneConnect UCNAs and first-generation CNAs. The Emulex OneConnect UCNA driver package for Windows Server is the same for all of these adapters. This feature streamlines the driver qualification process, protects previous investments and reduces TCO.

To continue with the application, download from the "Windows Downloads for Emulex OCe10102 UCNA" page and complete the installation:

4. Scroll down to the Drivers and Applications section and click on the Download icon for the driver kit.

5. Once the download has completed, click on AutoPilot Installer to extract the contents of the kit.

6. Follow the series of prompts as the host recognizes the installed adaptors.

7. Select "driver" in management application installation.

8. Select the OneCommand Manager application.

Note—Managing multiple adapters (NIC, FCoE and/or iSCSI) with OneCommand Manager is very similar to managing Fibre Channel HBAs in HBAnyware. OneCommand Manager streamlines adapter administration for converged networking with centralized cross-platform, cross-protocol management capabilities.

Managing multiple adapters

Figure 8 shows a OneCommand Manager screen shot with the adapter information.
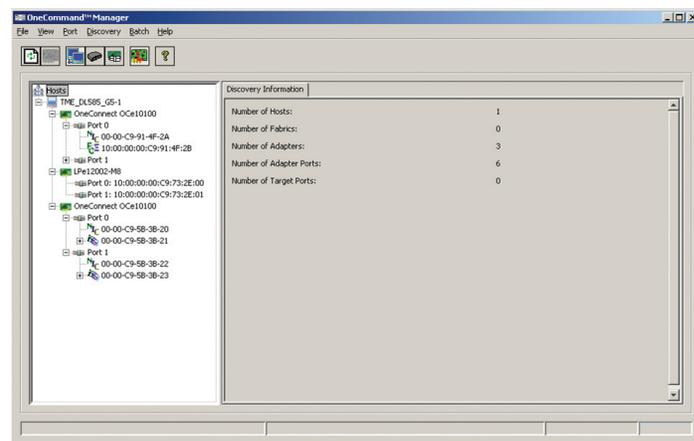
Figure 8 Managing multiple entities with OneCommand Manager is straightforward

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The OneConnect OcE adapter icon is positioned under the Windows Server icon in the top left:

- Click on the OneConnect OCe101000 icon to view Port 0 and Port 1

- Two entities are represented under each port:

  - The NIC icon provides the MAC address

  - The FCoE icon provides the worldwide port name

  (**Note**—A red FCoE icon indicates a link-down status as show in Figure 8; a green FCoE icon would indicate a link-up status.)

- Click on the FCoE icon and select the "Driver Parameters" tab to the far right. For those familiar with managing Emulex Fibre Channel adaptors, the same parameter capabilities and management practices apply (see Figure 9).
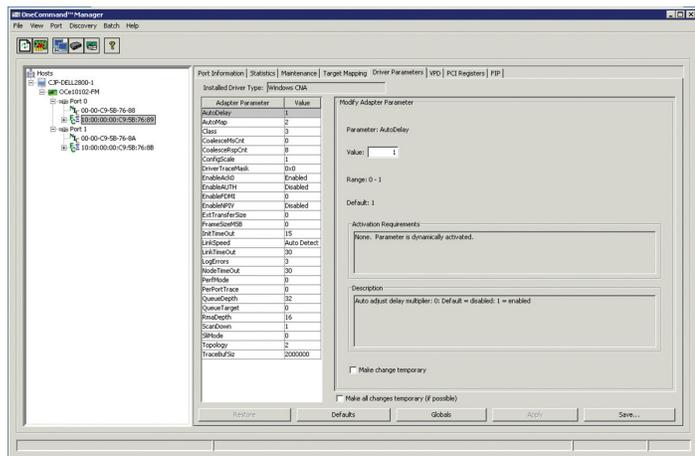
Figure 9 IT administrators accustomed to HBAnyware will find OneCommand Manager's management practices familiar and easy to use

Activating the SAN Component

Once you've configured the Emulex OneConnect FcoE adapter, you must also ensure that the FCF port on the switch has been configured to support FCoE.

Zoning, which provides isolation of sensitive data in a SAN, is based on a World Wide Port Name (WWPN) that uniquely identifies the adapter (either HBA or CNA) that is installed on a server. Zoning practices and storage configuration practices remain the same for CNAs as they are for HBAs. An IT administrator can define relationships between WWPNs and Logical Unit Numbers (LUNs) that restrict access to data. Once access is gained to the LUNS, multi-path I/O components or virtual disk services can be installed.

Conclusion

Network convergence is a critical opportunity for enterprise data centers to achieve significant savings and efficiencies. FCoE technology enables network convergence in enterprise data centers and provides benefits such as infrastructure simplification, investment protection and lowered TCO. FCoE provides these benefits without disrupting existing architectures and operating models. Emulex OneConnect FCoE CNAs are the right converged network storage connectivity solution, fully compatible with Windows Server 2003, 2008, and 2008 R2.

The streamlined configuration and management capabilities of Emulex AutoPilot Manager and OneCommand Manager are geared toward increasing overall productivity and efficiency for networked storage administrators. This directly translates into reduced operating costs and lower total cost of ownership.

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